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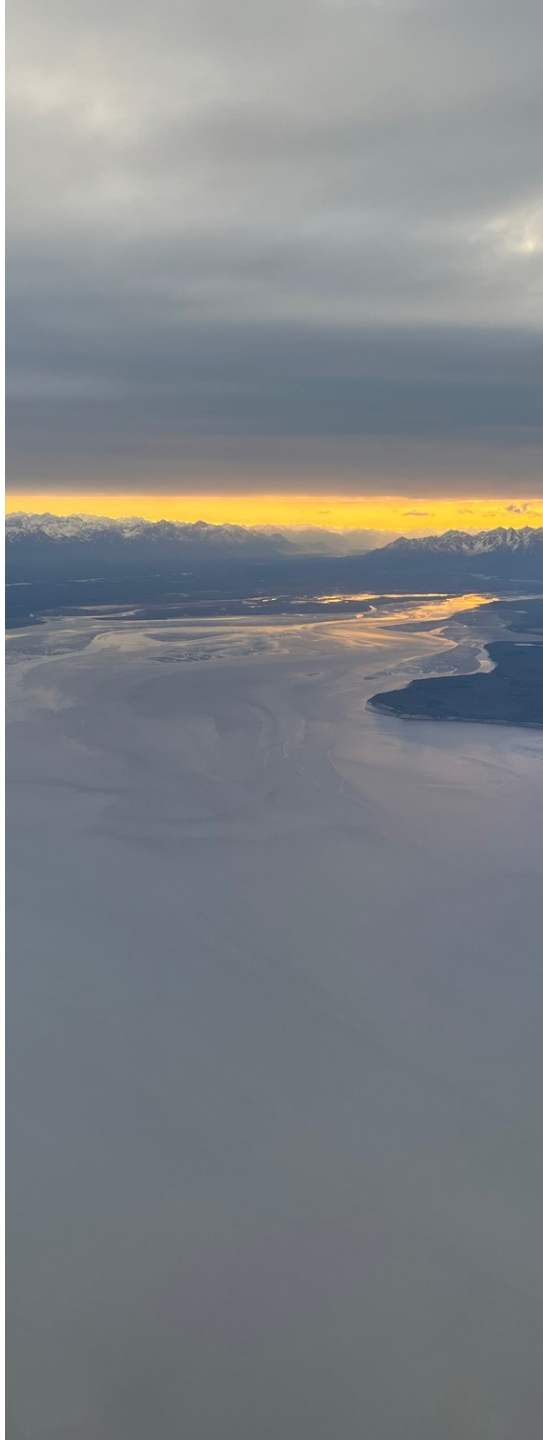

Update on St. Mary's MiGRIDS analysis

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Renewable and Distributed Systems Integration

ALASKA WIND WORKING GROUP MEETING NOVEMBER 2023

Based on work by VanderMeer, Green, Darbali-Zamora and Thompson, doi: 10.1109/ACCESS.2023.3327693.

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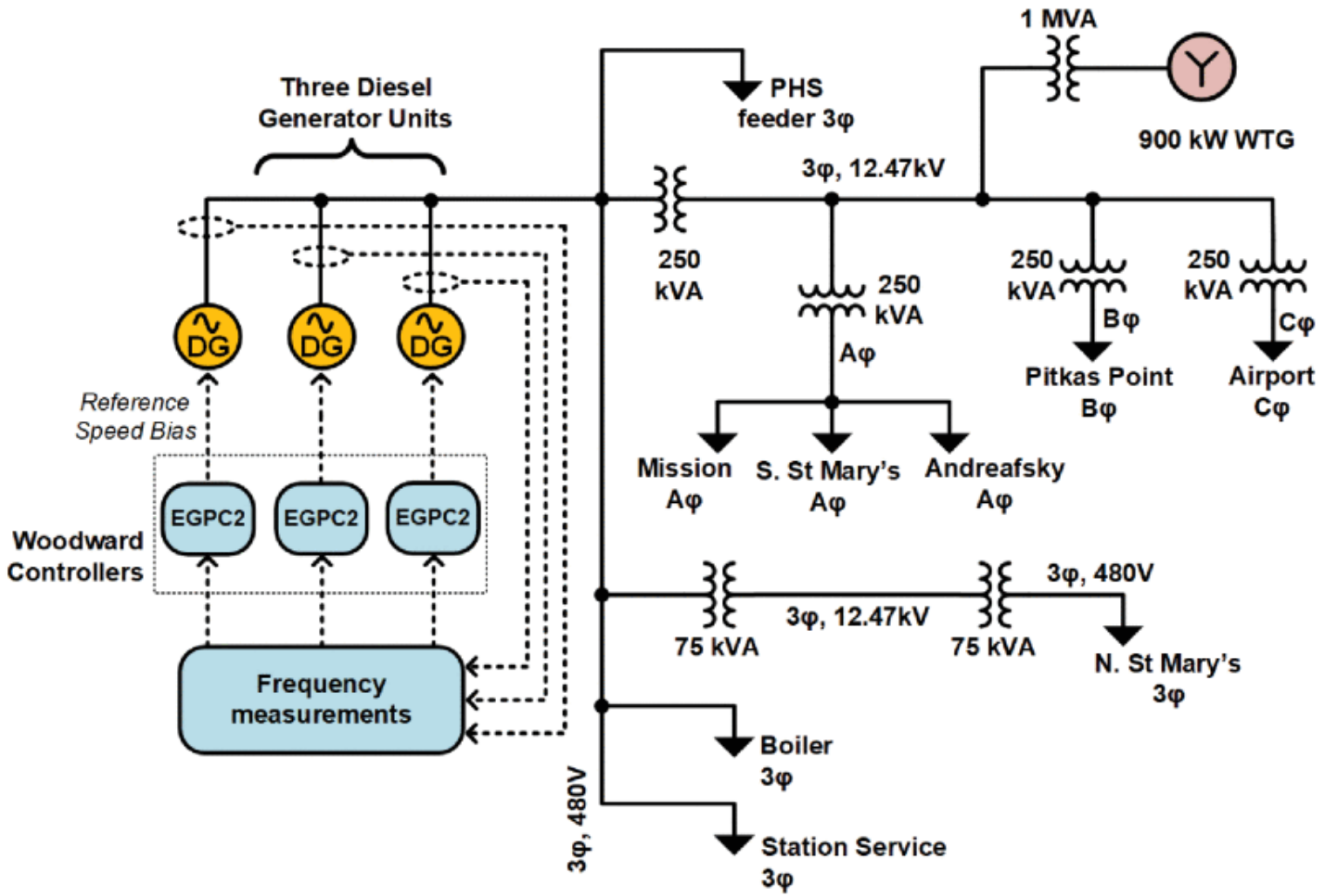
The St. Mary's – Mountain Village electrical system

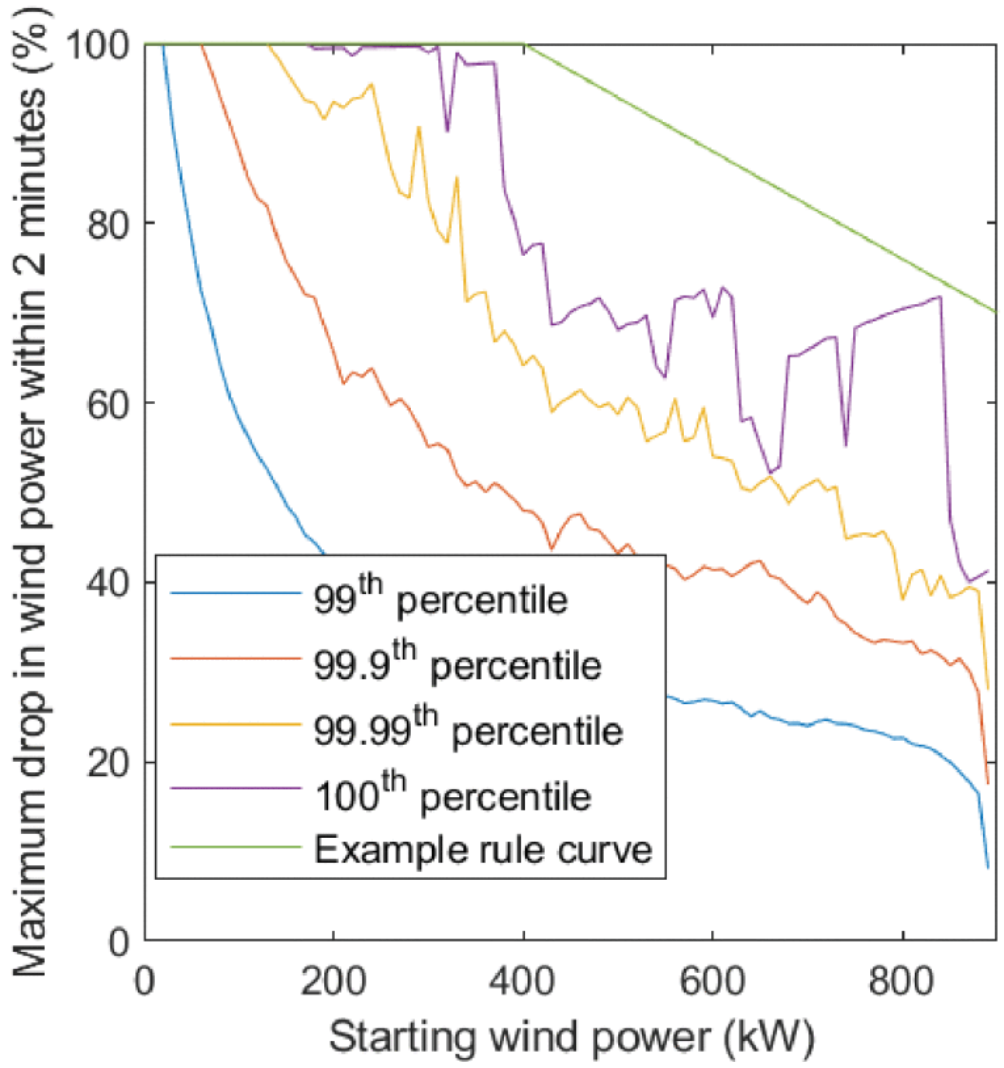


EWT 900 kW model DW54 900HH50 variable-pitch turbine

Research questions

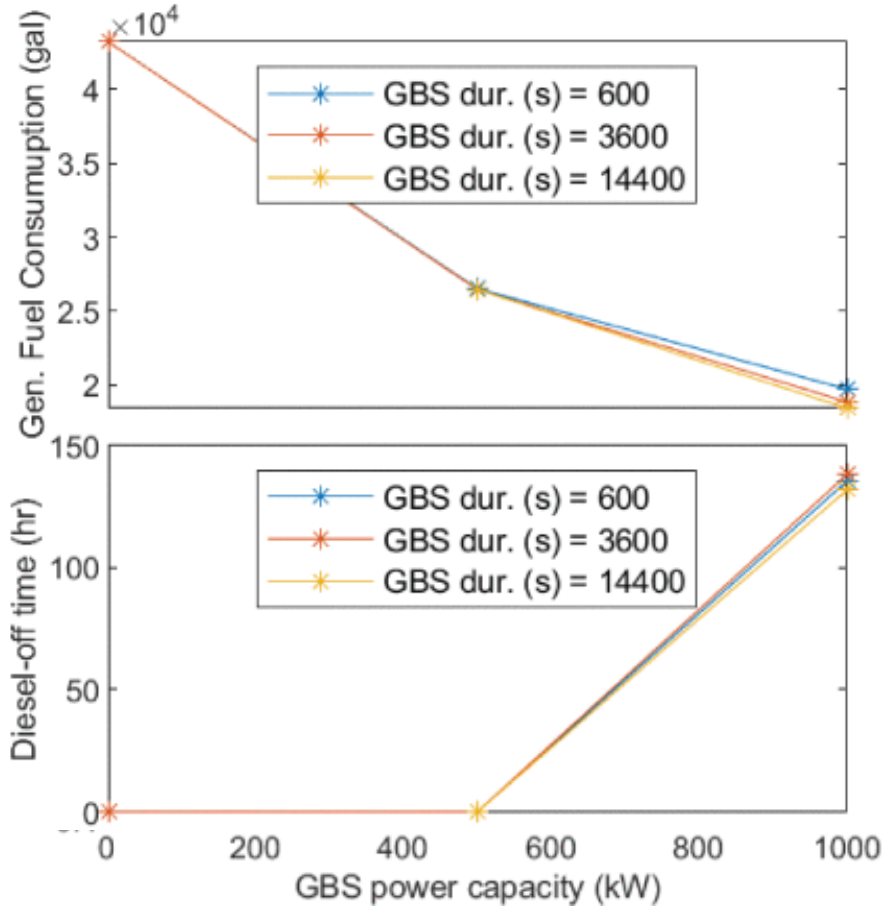
- How to best integrate the wind turbine with the existing Diesel gensets?
  - Minimize fuel consumption
  - Reduce wear and tear of gensets
- What are effective ways to optimize integration?
  - Optimize spinning reserve capacity
  - Use Grid Bridging system
  - Use wind forecasting
  - Use highly controllable thermal energy storage
- Tools for optimization:
  - MiGRIDS (Micro Grid Renewable Integration Dispatch and Sizing)

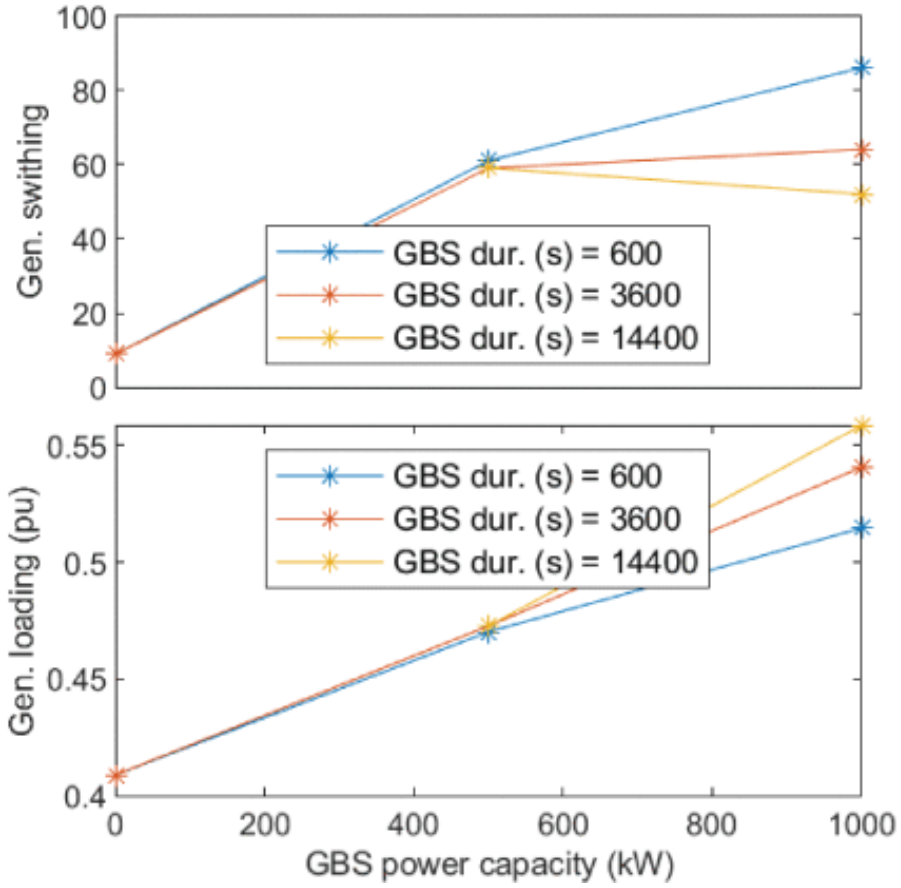
How much spinning reserve is really needed?



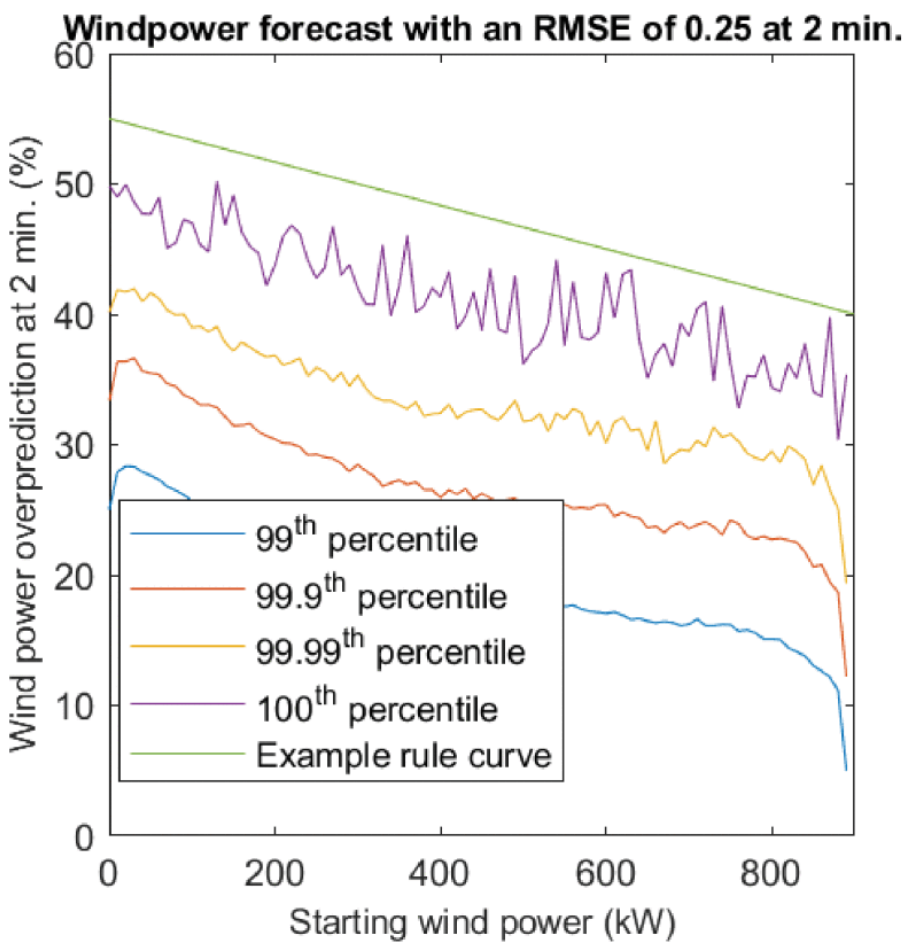
- Conventional wisdom is to back any wind generation with an equivalent amount of spinning Diesel
- Statistical analysis reveals that this is not needed – if the turbine is spinning at high capacity, it is unlikely to drop to no capacity within two minutes

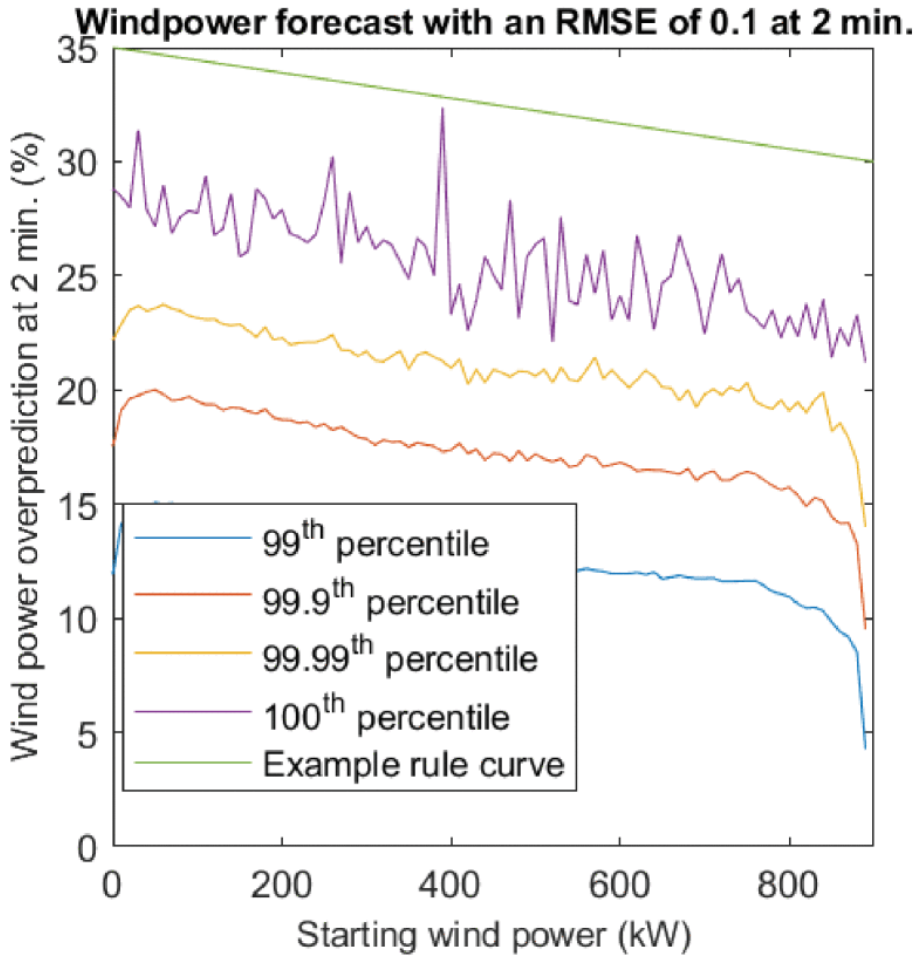
Benefits of using a Grid Bridging System



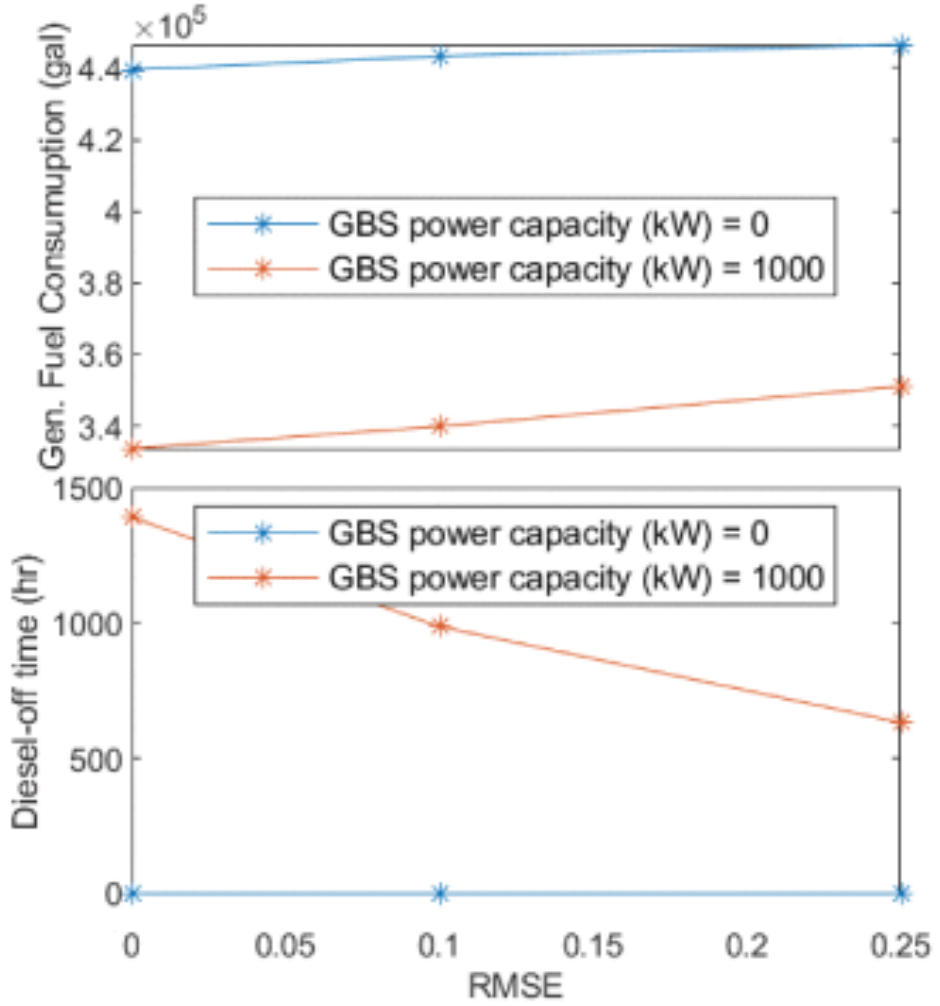


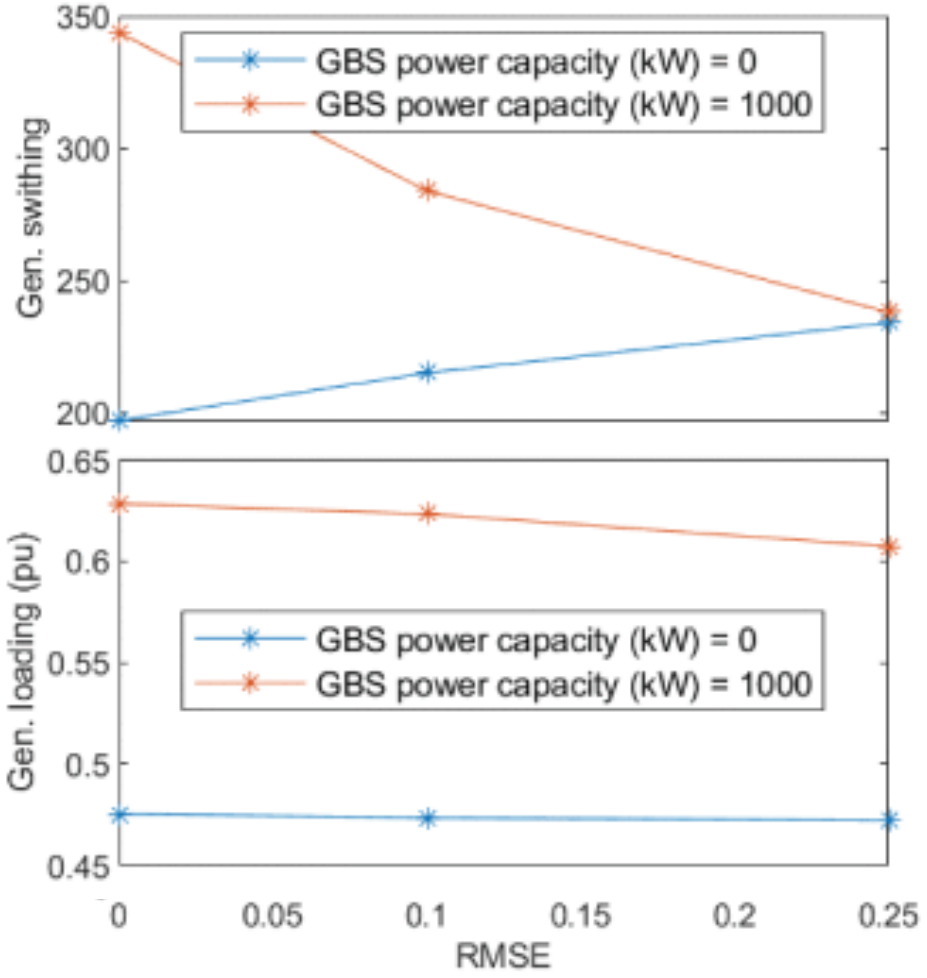
Wind forecasting helps, but needs to be accurate



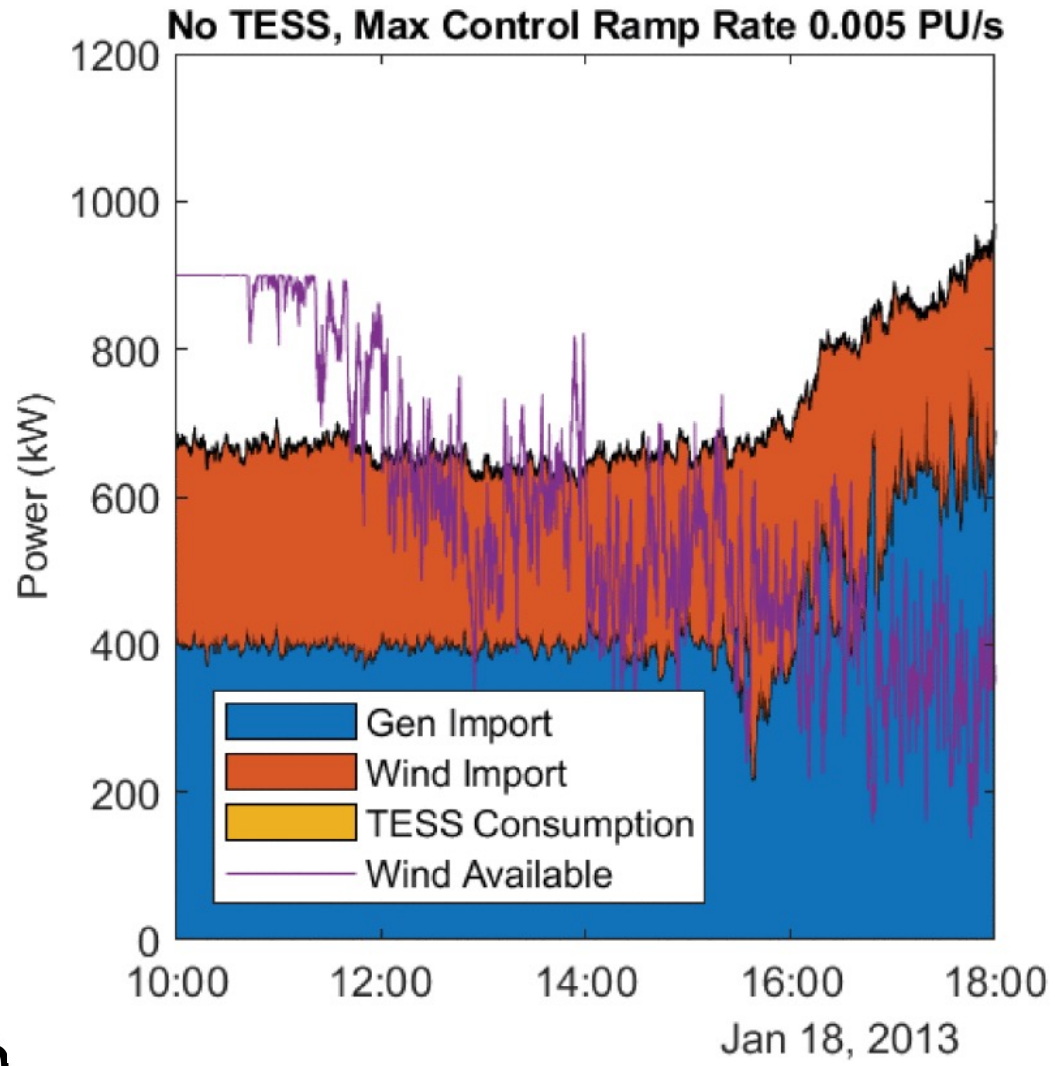


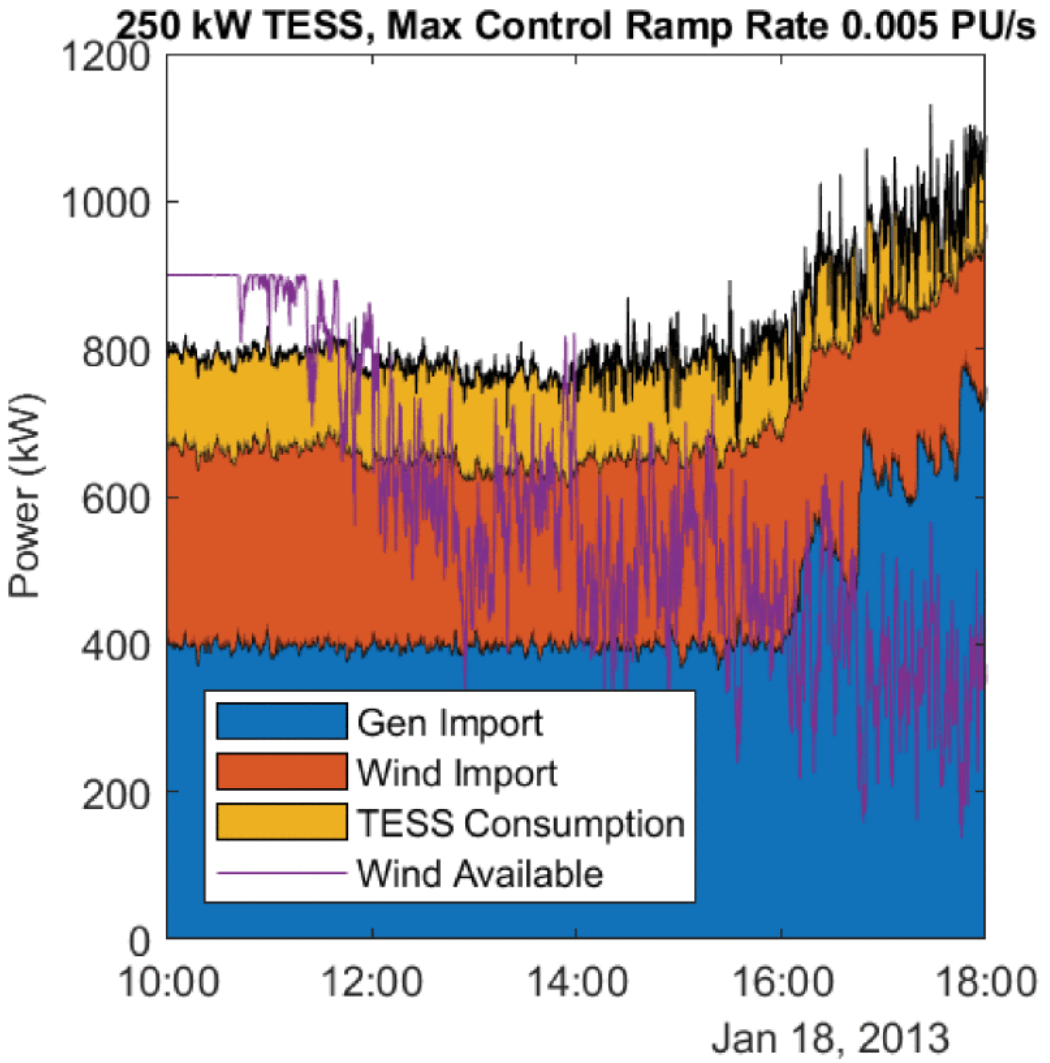
Wind forecasting and GBS combined effect





Using thermal storage to improve WTG output stability





Summary of findings

- SRC can be optimized more than common practice, even unaided
- GBS is the best way to reduce fuel consumption and maintenance, and capacity is more important than duration
- Forecasting helps, especially when combined with GBS
- Thermal storage can help to stabilize WTG production, reducing DG ramp rates and underloading, but also reducing wind imports to the grid

Acknowledgments

- Material in this presentation is sourced from “J. B. VanderMeer, N. Green, R. Darbali-Zamora and W. Thompson, "MicroGrid Renewable Integration Dispatch and Sizing (MiGRIDS) Analysis of Spinning and Regulating Reserve Options for Wind in an Alaskan Diesel Microgrid," in IEEE Access, vol. 11, pp. 121637-121645, 2023, doi: 10.1109/ACCESS.2023.3327693.”
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Questions?